National Aeronautics and Space Administration

NASA's Exploration Plans & Progress

AIAA Joint Propulsion Conference

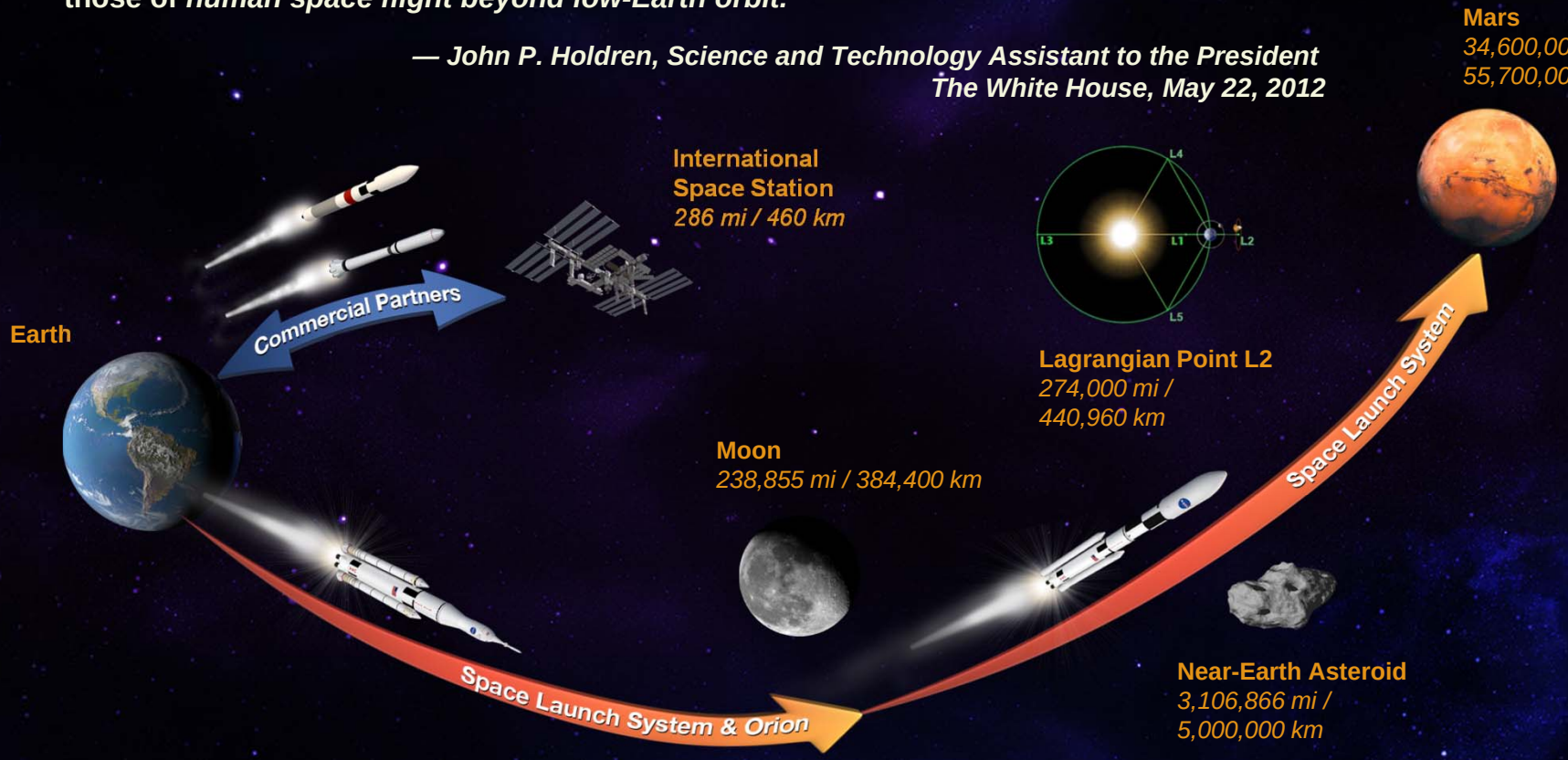
Chris Singer, Director
Engineering Directorate
NASA Marshall Space Flight Center

July 2012

The Future of Exploration

"This expanded role for the private sector will free up more of NASA's resources to do what NASA does best — tackle the most demanding technological challenges in space, including those of *human space flight beyond low-Earth orbit.*"

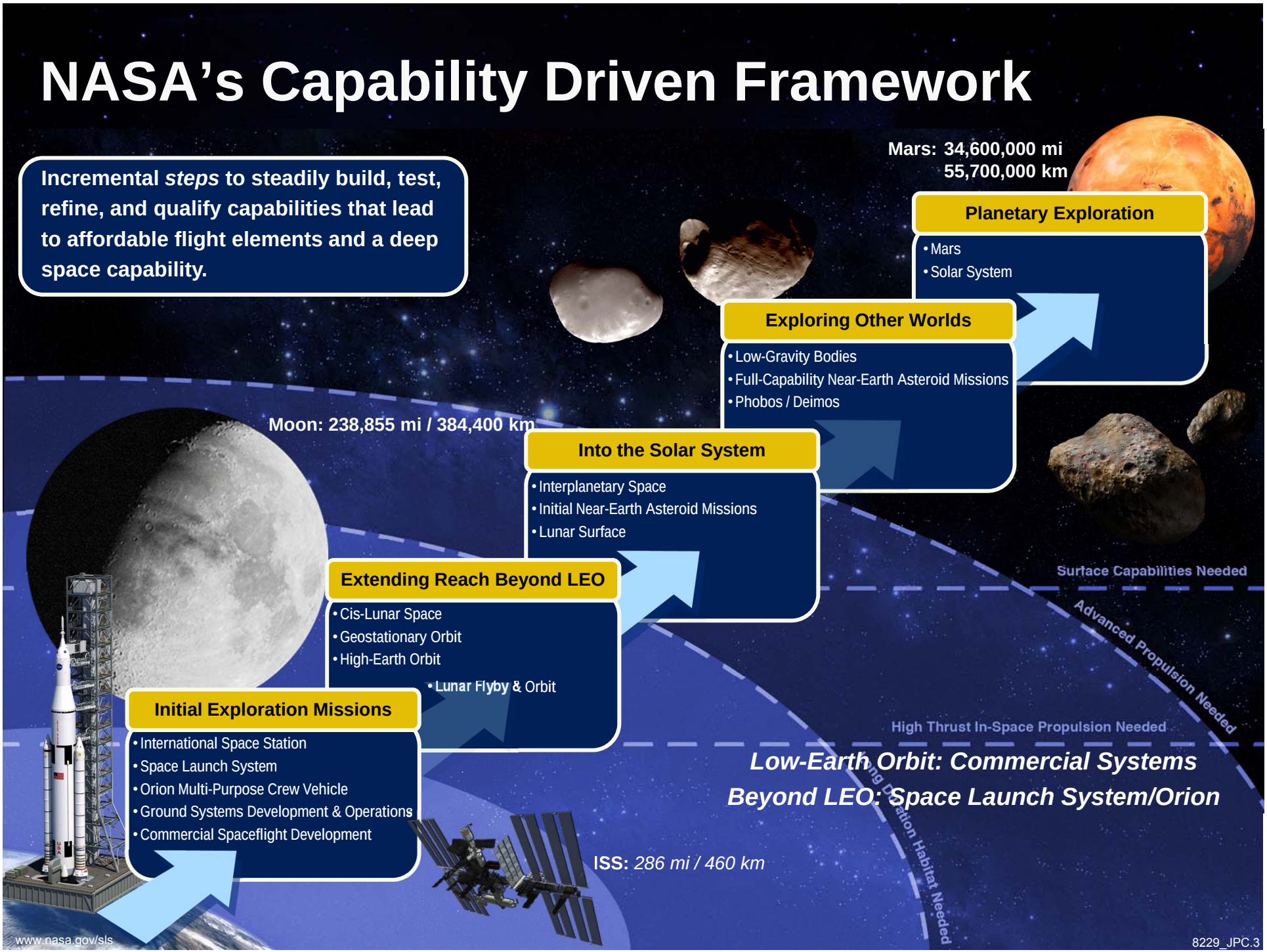
— John P. Holdren, Science and Technology Assistant to the President
The White House, May 22, 2012



"My desire is to work more closely with the human spaceflight program so we can take advantage of synergy. We think of the SLS as the human spaceflight program, but it could be hugely enabling for science."

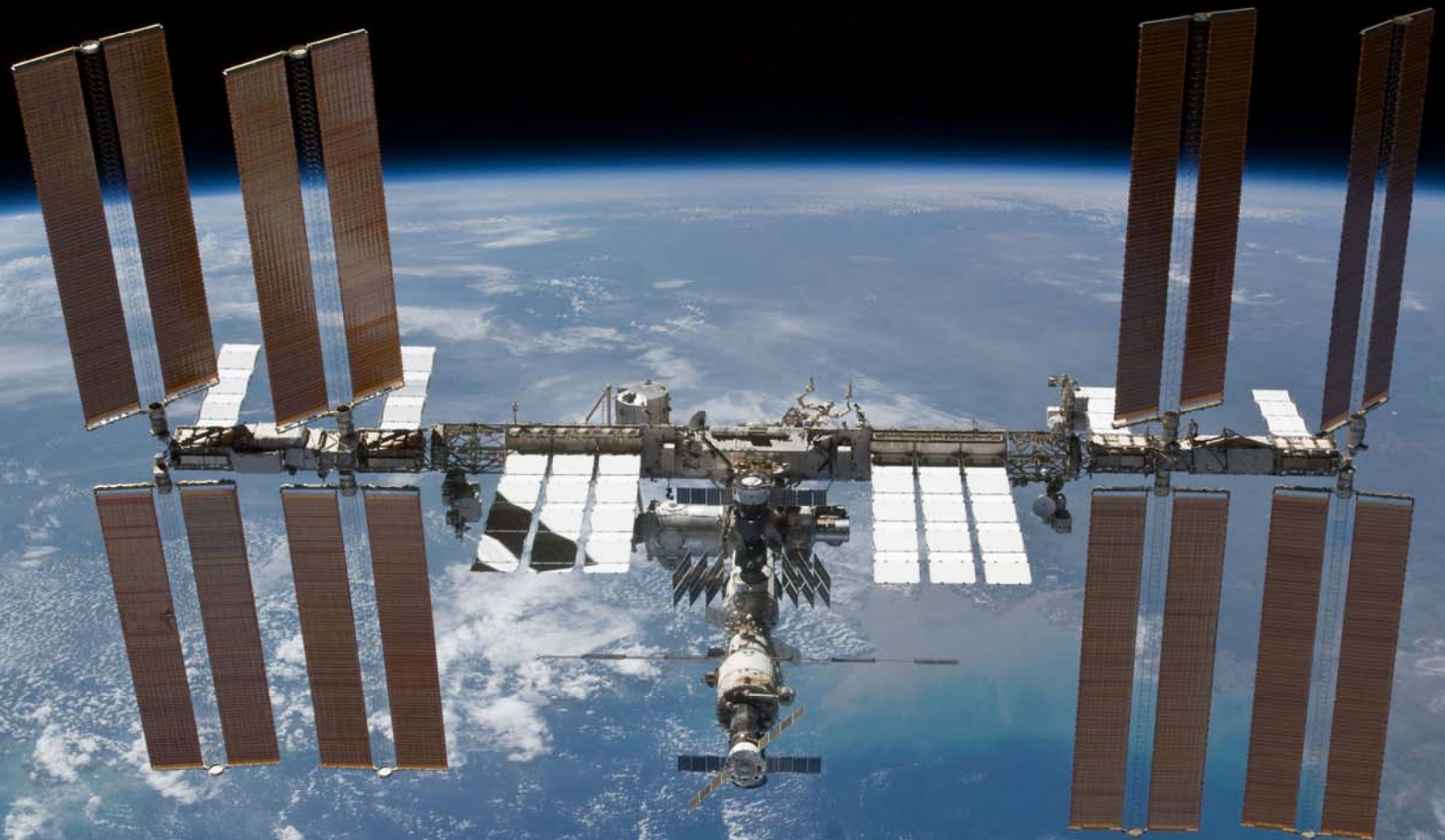
— John Grunsfeld, Associate Administrator
NASA Science Mission Directorate
Nature, Jan 19, 2012

NASA's Capability Driven Framework



The International Space Station

Scientific Laboratory • Technology Test Bed •
Orbiting Outpost • Galactic Observatory



Sustain Human Health and Performance • Ensure Systems Readiness •
Validate Operational Procedures

Commercial Spaceflight Development Partners

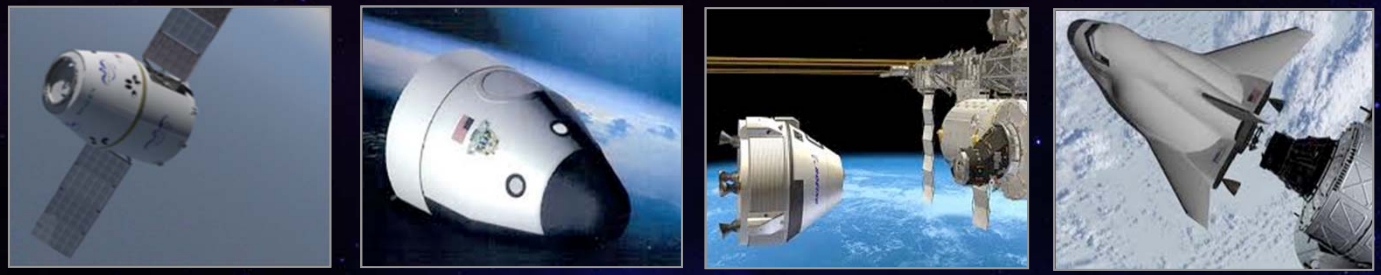
Cargo Transportation

Space Exploration Technologies (SpaceX) and Orbital Sciences Corp.

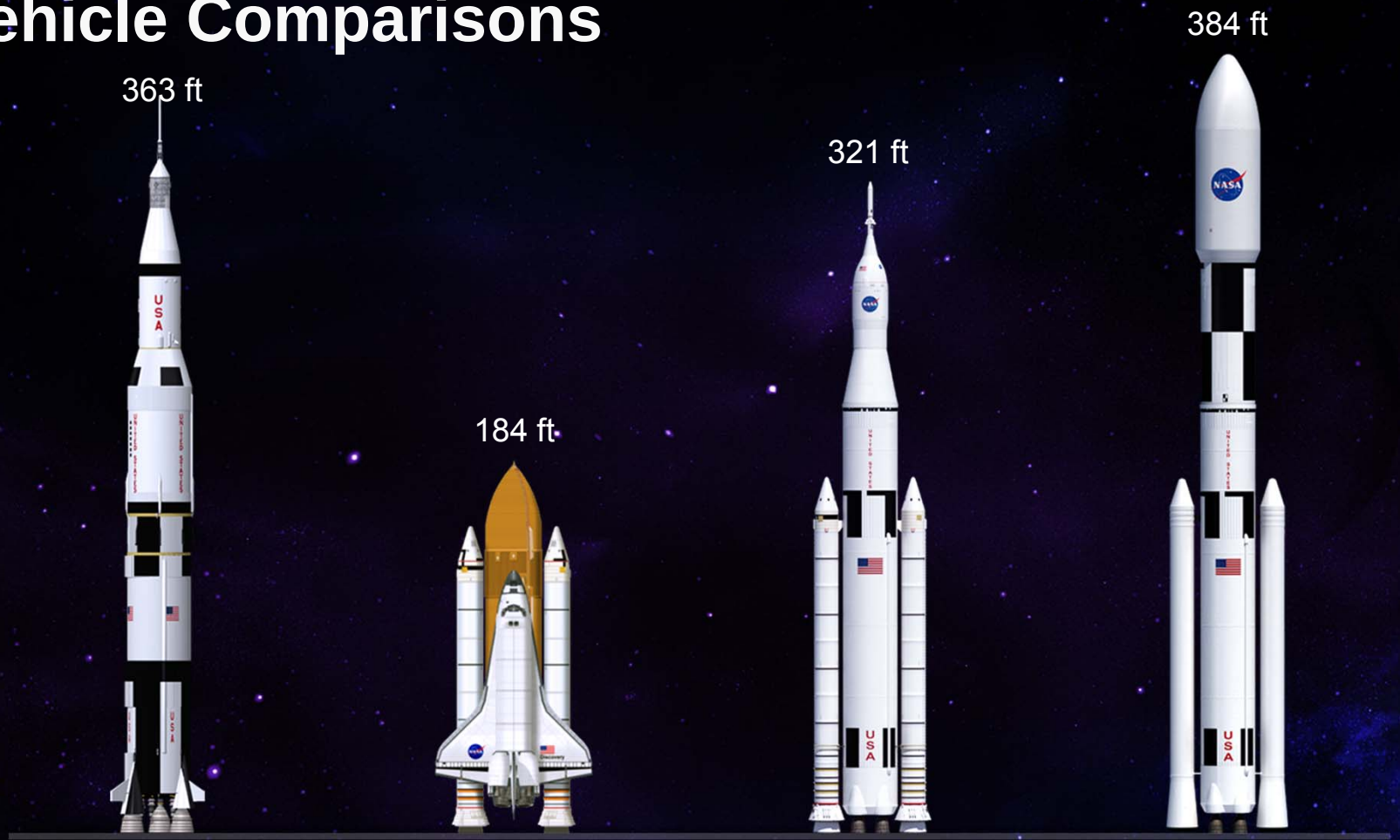
Future Crew Transportation

Funded Partners: SpaceX, Blue Origin, Boeing, Sierra Nevada Corporation

Unfunded Partners: Alliant Techsystems Inc., Excalibur Almaz, United Launch Alliance



Vehicle Comparisons



Saturn V	Space Shuttle	SLS 70 Metric Tons	SLS 130 Metric Tons
7,610,000 pounds of thrust	**7,800,000** pounds of thrust	**8,400,000** pounds of thrust	**9,200,000** pounds of thrust
262,000 pounds of payload	**65,000** pounds of payload	**154,000** pounds of payload	**286,000** pounds of payload

www.nasa.gov/sls

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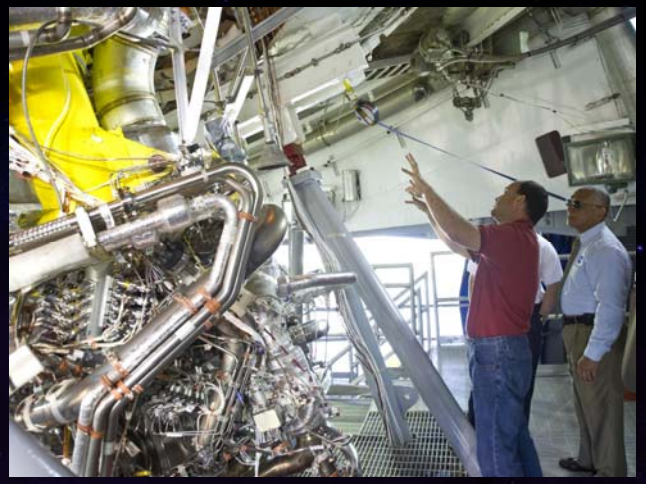
Space Launch System Program: Marshall Space Flight Center

Stages Industry Day at Michoud Assembly Facility, Nov 2011

KSC Launch Complex 39B for SLS/Orion operation



J-2X Upper Stage Engine at Stennis Space Center (SSC), April 2012

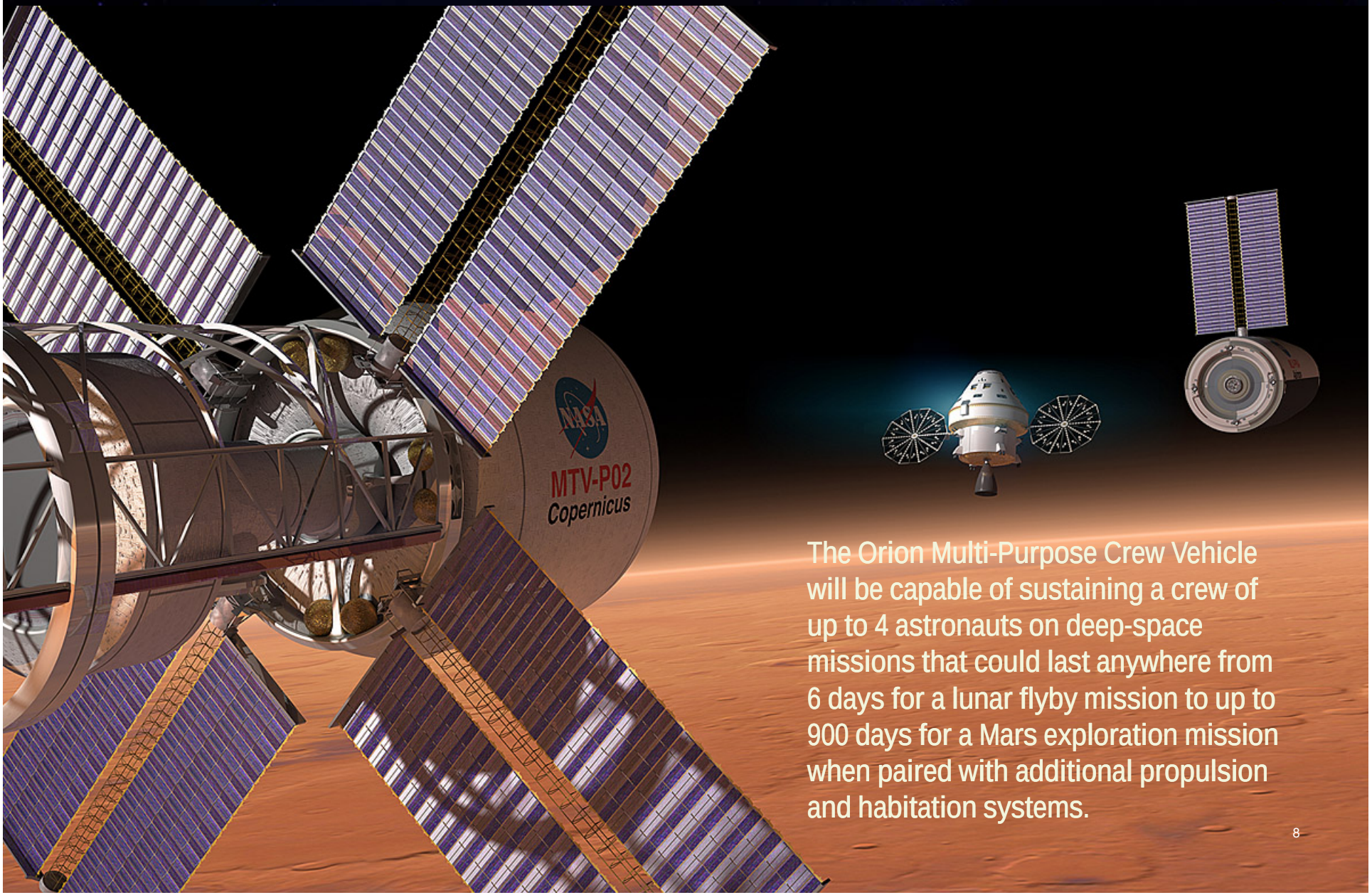
Solid Rocket Booster development motor test in Promontory, Utah, Sep 2011

RS-25 Core Stage Engine in Engine Processing Facility at KSC, 2011

Subscale Solid Rocket Motor firing at MSFC, Mar 2012

J-2X Upper Stage Engine powerpack test at SSC, Feb 2012

Orion Multi-Purpose Crew Vehicle Program: Johnson Space Center



The Orion Multi-Purpose Crew Vehicle will be capable of sustaining a crew of up to 4 astronauts on deep-space missions that could last anywhere from 6 days for a lunar flyby mission to up to 900 days for a Mars exploration mission when paired with additional propulsion and habitation systems.

Ground Systems Development and Operations Program: Kennedy Space Center

Government and Commercial Launch Services

The Capability To Go Anywhere …

"Space Launch System/Orion and commercial crew … have to co-exist. They have different destinations; they must be executed in parallel … (and) rather than fighting each other for how big our respective splices should be (of the government allocation that NASA gets), I think we should be fighting together for a bigger pie."

Michael Lopez-Alegria
Former Astronaut and President, Commercial Spaceflight Federation
Space News, May 21, 2012

- **NASA's exploration strategy expands America's presence in space and contributes to economic growth**
- **Partnerships with commercial space for low-Earth orbit markets**
- **Engaging U.S. aerospace for beyond-Earth orbit exploration for the first time since Apollo**
- **Creates opportunities to enrich the future for people around the world**
- **We will explore new places where no one has ever gone before**